

FIG. 31 illustrates a eighth embodiment exhaust arrangement in accordance with the present invention. This arrangement is somewhat similar to the embodiments described above, and in the description and illustration of this embodiment, like parts have been given like numerals to those utilized in the description and illustration of the embodiments above, except that a "g" designator has been added thereto.

In this arrangement, the cylinder coolant jackets 137g in the cylinder block 52g are combined with the exhaust passage cooling jacket 133g into a single large "U"-shaped passage positioned between the cooling water return passage 139g and the exhaust passage 92g in the valley of the cylinder block 52g between the banks 55g, 57g. Because these two coolant paths are combined, they require less engine space. This permits the exhaust passage 92f to be enlarged as compared to the arrangement illustrated in FIG. 27.

FIG. 32 illustrates a ninth embodiment exhaust arrangement in accordance with the present invention. This arrangement is somewhat similar to the embodiments described above and in the description and illustration of this embodiment, like parts have been given like numerals to those utilized in the description and illustration of the embodiments above, except that an "h" designator has been added thereto.

This arrangement is similar to that illustrated in FIG. 27 except that the cylinder liners or sleeves (51f in that Figure) have been removed. Instead, the inside surface of each cylinder 50h is plated with a durable material. This plating has a cross-sectional thickness which is much less than the thickness of the sleeve.

By removing the sleeves, the cylinder block walls in the inside of the "V" may be made thinner, and thus the space within the "V" made larger. This permits the exhaust passage 92h to be much larger in cross-sectional dimension, reducing exhaust backpressure.

In each embodiment disclosed, an exhaust system is provided which permits the engine and thus the outboard motor, to retain a small profile. This is primarily accomplished by locating one or more exhaust passages with the valley between the cylinder banks of the engine. At the same time, the exhaust passages are not restricted, so that exhaust back-pressure is minimized. Also, the exhaust system is arranged to prevent overheating of the lubricating system.

Of course, the foregoing description is that of preferred embodiments of the invention, and various changes and modifications may be made without departing from the spirit and scope of the invention, as defined by the appended claims.

What is claimed is:

1. An outboard motor comprised of a power head containing an internal combustion engine surrounded by a protective cowling, a driveshaft housing and lower unit depending from said power head and containing a propulsion device for propelling an associated watercraft, a transmission contained in said driveshaft housing and lower unit for driving said propulsion device from said engine, said engine having a cylinder block having a first cylinder head connected thereto and cooperating therewith to define a first cylinder bank containing at least one cylinder and a second cylinder head connected thereto and cooperating therewith to define a second cylinder bank containing at least one cylinder, said first and second banks arranged generally in a vertically extending "V" shape and defining a vertically extending valley therebetween, an exhaust system for dis-

charging exhaust gases from said engine to the atmosphere at least in part through said driveshaft housing and lower unit said exhaust system including at least one exhaust passage extending from each cylinder through its respective cylinder head towards said valley and a vertically extending exhaust manifold in said valley for collecting exhaust gases from said exhaust passages said exhaust manifold terminating in a single downwardly extending discharge passage extending into said driveshaft housing and lower unit, an exhaust cooling jacket surrounding said single discharge passage and said exhaust manifold, an engine body cooling jacket formed in said cylinder heads and said cylinder block, and means for delivering cooling water from the body of water in which the associated watercraft is operating first to said exhaust cooling jacket and from said exhaust cooling jacket to said engine body cooling jacket.

2. The exhaust system in accordance with claim 1, wherein there is a separate exhaust manifold associated with each cylinder bank, each of said exhaust manifolds having a collector section terminating at a common outlet formed.

3. The exhaust system in accordance with claim 1, wherein there is a separate exhaust manifold associated with each cylinder bank, each of said exhaust manifolds having a collector section terminating at a common outlet formed near a vertical midpoint of said engine.

4. The exhaust system in accordance with claim 1, wherein said engine is supported upon an exhaust guide, said exhaust guide having an exhaust passage therethrough leading from said discharge passage.

5. The exhaust system in accordance with claim 4, wherein said single passage is connected to said exhaust guide via a flexible hose.

6. The exhaust system in accordance with claim 1, wherein there is a separate exhaust manifold associated with each cylinder bank, each of said exhaust manifolds having a collector section terminating at a common outlet, said engine is supported upon a top of an exhaust guide, said exhaust guide having a pair of passages therethrough, each exhaust common outlet leading to a respective one of said pair of passages through said exhaust guide.

7. The exhaust system in accordance with claim 6, wherein an exhaust pipe extends from a bottom of said exhaust guide, said exhaust pipe having a first branch connected to one of said pair of passages through said exhaust guide and a second branch connected to said other of said pair of passages, said branches merging into a single passage.

8. An exhaust system for an engine having a cylinder block having a first cylinder head connected thereto and cooperating therewith to define a first cylinder bank containing at least one cylinder and a second cylinder head connected thereto and cooperating therewith to define a second cylinder bank containing at least one cylinder, said first and second banks arranged generally in a "V" shape and having a valley therebetween, a main exhaust passage positioned within an exhaust manifold connected to said engine and extending through said valley to an end of said engine, at least one passage extending from each cylinder through its respective cylinder head inwardly to said exhaust manifold and a starter motor is positioned in a space between said exhaust manifold and said engine.

9. The exhaust system in accordance with claim 8, wherein a passage is defined through said manifold from each exhaust passage leading from a combustion chamber to said main exhaust passage.

10. The exhaust system in accordance with claim 8, wherein each cylinder head has an exhaust manifold mount-

ing surface to which said manifold is mounted, said surfaces extending in generally parallel planes.

11. The exhaust system for an engine having a cylinder block having a first cylinder head connected thereto and cooperating therewith to define a first cylinder bank containing at least one cylinder and a second cylinder head connected thereto and cooperating therewith to define a second cylinder bank containing at least one cylinder, said first and second banks arranged generally in a "V" shape and having a valley therebetween, a main exhaust passage defined within said valley by said cylinder heads and cylinder block and extending through said valley to an end of said engine and at least one passage extending from each cylinder through its respective cylinder head inwardly to said main exhaust passage, said engine including a lubricant passage and a coolant passage extending through said valley, said coolant passage Hug positioned between said lubricant passage and said main exhaust passage.

12. The exhaust system for an engine having a cylinder block having a first cylinder head connected thereto and

cooperating therewith to define a first cylinder bank containing at least one cylinder and a second cylinder head connected thereto and cooperating therewith to define a second cylinder bank containing at least one cylinder said first and second banks arranged generally in a "V" shape and having a valley therebetween, a main exhaust passage defined within said valley by said cylinder heads and cylinder block and extending through said valley to an end of said engine and at least one passage extending from each cylinder through its respective cylinder head inwardly to said main exhaust passage, a coolant jacket extending about said exhaust passage, a coolant passage positioned within said cylinder block adjacent each combustion chamber, and at least one oil passage extending through said valley generally parallel to said main exhaust passage, said coolant jacket and coolant passage extending between said at least one oil passage and said exhaust passage.

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13. An outboard motor comprising an engine, said engine having a cylinder block and at least one cylinder head, at least one cylinder defined within said cylinder block and said cylinder block being mounted generally above an exhaust guide, a cylinder head exhaust passage extending from said cylinder through said cylinder head, said exhaust guide including an exhaust guide passage, said cylinder block including a cylinder block exhaust passage, and said exhaust guide passage and said cylinder head exhaust passage being in communication with each other through said cylinder block exhaust passage.

14. The outboard motor of Claim 13, wherein said engine has a v-type configuration.

15. The outboard motor of Claim 13 further comprising a manifold interposed between said cylinder block exhaust passage and said cylinder head passage.

16. An outboard motor comprising an internal combustion engine, an exhaust guide plate being positioned generally below said internal combustion engine and including an exhaust guide passage, said internal combustion engine comprising a generally vertically extending crankshaft and a cylinder block having a pair of cylinder banks inclined relative to one another, each of said pair of cylinder banks including at least one cylinder, a cylinder head assembly enclosing said cylinder, said cylinder head assembly comprising at least one exhaust port and at least one corresponding exhaust runner, said exhaust runner being in selective communication with said exhaust port and being formed between said exhaust port and an exhaust manifold such that said engine includes two exhaust manifolds that extend in generally vertical directions, a pair of connecting exhaust conduits communicating with said exhaust manifolds and extending

toward said cylinder block, said cylinder block also having a pair of passages formed therein that are in registry with said connecting exhaust conduits, said passages merging within said cylinder block into an exhaust discharge, and said exhaust discharge being coupled to said exhaust guide passage.

17. An outboard motor comprising a first cylinder bank and a second cylinder bank, said first cylinder bank and said second cylinder bank being inclined relative to one another and jointly forming at least a portion of a cylinder block, a crankcase cover connected to a portion of said cylinder block and defining a crankcase chamber, a generally vertically extending crankshaft extending through said crankcase chamber between said crankcase cover and said cylinder block, a first cylinder head assembly being attached to said first cylinder bank and a second cylinder head assembly being attached to said second cylinder bank, a first exhaust manifold being connected to said first cylinder head assembly, a second exhaust manifold being connected to said second cylinder head assembly, an exhaust passage being formed in said cylinder block and comprising a first branch, a second branch and a convergent portion that combines said first branch and said second branch, and said first and second exhaust manifolds separately communicating with said first and second branches respectively.

18. The outboard motor of Claim 17, wherein said first and second exhaust manifolds communicate with said first and second branches through a first connection passage and a second connection passage respectively.

19. The outboard motor of Claim 18, wherein said first and second connection passages are formed within said first cylinder head assembly and said second cylinder head assembly respectively.

20. The outboard motor of Claim 17, wherein said first and second exhaust manifolds are positioned between said first and second cylinder head assemblies.